THE GREAT LAKES TART CHERRY INDUSTRY

PRODUCTION COSTS

U.S. DEPARTMENT OF AGRICULTURE•ECONOMIC RESEARCH SERVICE•MARKETING ECONOMICS DIVISION•IN COOPERATION WITH THE NEW YORK, PENNSYLVANIA, AND MICHIGAN AGRICULTURAL EXPERIMENT STATIONS • ERS-171

FOREWORD

Estimates of tart cherry production costs have been prepared in independent studies in New York, Pennsylvania, and Michigan. Also, an estimate for Wisconsin has been prepared, based largely on the Michigan study. This publication combines major findings of those studies and attempts to make appropriate adjustments to increase uniformity and comparability of cost estimates.

This is the first of three planned publications on the economics of the tart cherry industry. Future reports will concern processing costs and interregional competition.

CONTENTS

Washington, D. C. May 1964

SUMMARY

Tart cherries are produced commercially in five Great Lakes States and six Western States, but in recent years 90 percent or more of the crop has been produced in only four of these states--Michigan, New York, Pennsylvania, and Wisconsin.

Production varies widely from year to year. It increased rapidly after World War II but has not changed much since 1950.

Nearly all U.S. tart cherries are either canned or frozen. The proportion of the annual tart cherry crop frozen has increased in recent years, while the "canned," and "fresh and home use" percentages have decreased.

Growing and harvesting cost estimates are presented for the four major tart cherry States of Michigan, New York, Pennsylvania, and Wisconsin. Total growing and harvesting costs are shown to vary relatively little from State to State, although important differences in individual cost component estimates are shown.

The cost estimates indicate that yield is an important determinant of total cost per pound. Average cost estimates at yields of 6 tons per acre are approximately one-third as great as at 1 ton per acre.

Cost and returns estimates show that at a farm price of 7.5 cents per pound and growing cost of $200 per acre, a yield of approximately 5,000 pounds per acre is required for returns to equal expenses.

"Break-even" estimates given for several yield, price, and growing cost situations indicate the importance of these factors in determining net returns from tart cherry production.

THE GREAT LAKES TART CHERRY INDUSTRY: PRODUCTION COSTS

By

C. C. Dennis, B. A. Dominick, and B. W. Kelly 1/

INTRODUCTION

Tart cherries are produced in large areas of the United States, but most production is confined to only a few States and is concentrated in relatively small areas of these States. It is an important industry, as indicated by an average annual farm value approaching $20 million. It is especially important to those areas in which tart cherries are a major source of income.

Tart cherry production cost studies have been made in Michigan, New York, and Pennsylvania, and cost estimates have been prepared for Wisconsin. These States produce most of the tart cherries in the United States. The studies give tart cherry producers some measures by which they can compare operations. But, because tart cherries are produced over a wide area and there is strong inter-area competition, it is necessary to make comparisons between States and between producers within States. The main purpose of this bulletin, therefore, is to place the estimates of individual States on comparable bases, insofar as is possible, and to point out some of the primary cost and production input differences and the reasons for these differences.

The input and cost figures presented are averages for a sample of producers in each State. A large amount of variation exists among producers within States--often more than exists among the averages shown for States or areas. A cost advantage or disadvantage for a State, therefore, is an advantage or disadvantage for "average" producers. Costs of individual producers may vary considerably from the averages for their States.

INDUSTRY CHARACTERISTICS

To place these cost studies in perspective, it is necessary first to understand various industry characteristics. Therefore, a discussion of industry size, location, products, and prices precedes the cost study.

Location of production

Tart cherries are produced commercially in five Great Lakes States and six Western States. The Great Lakes States of Michigan, New York, Pennsylvania, and Wisconsin have produced more than 90 percent of the crop in recent years. Ohio produces approximately 1 percent, and the Western States of Colorado, Utah, Idaho, Montana, Oregon, and Washington produce the remainder of the commercial crop. Michigan has become the major tart cherry State, producing in excess of 60 percent of the crop in most years. New York follows, with about 15 percent, and Pennsylvania and Wisconsin contribute about 8 percent each.

Figure 1 compares tart cherry production in the United States, the Great Lakes States 2/, and the Western States. 3/ Figure 2 compares production in the four major

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2/ Michigan, New York, Wisconsin, Pennsylvania, and Ohio.

3/ Washington, Oregon, Colorado, Utah, Idaho, and Montana.

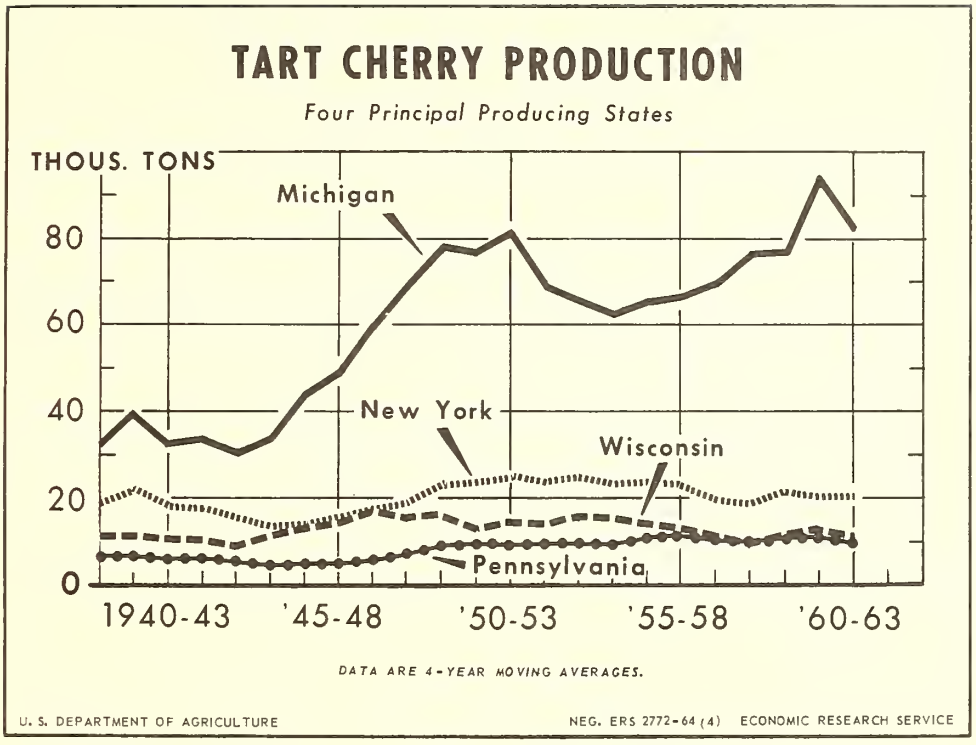

Figure 1

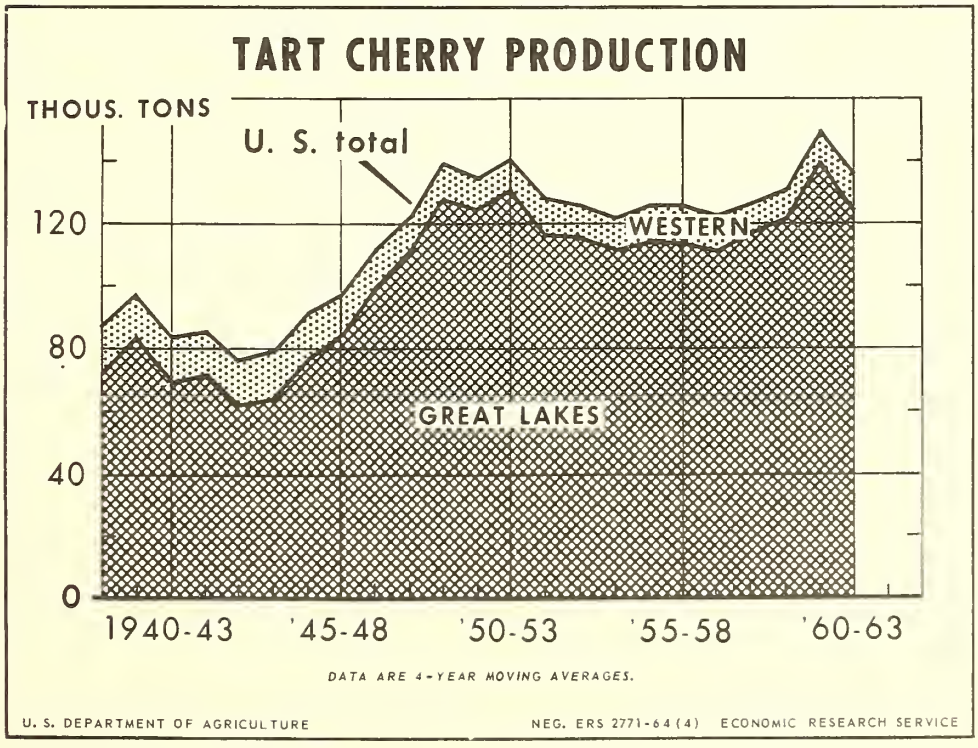

Figure 2

Great Lakes States. These figures give average annual production for 4-year periods to eliminate the effect of annual fluctuations and ease identification of long-time trends.

Western production has been moderate and has changed little in many years. Because of the stability of western production and the predominant position of the Great Lakes States, most of the variation in total U.S. production is due to change in Great Lakes production.

Michigan produces most of the crop in the Great Lakes area. Comparison of figures 1 and 2 shows that production has varied in the Great Lakes area much as it has in Michigan, and that Michigan production has increased irregularly in the post-World War II years. Pennsylvania production tended to increase in the period shown, while there was little or no change in New York or Wisconsin.

Annual production fluctuations are an important factor in the tart cherry industry. In the post-World War II period, production increases and decreases from the previous year have alternated, with only two exceptions (1950-51 and 1961-62). In 1951 and 1962, production was greater than the large crops of 1950 and 1961. The amount and pattern of alternating production can be seen in table 1. The percentage changes average 43 for increases and 27 for decreases, with much larger changes shown for individual years. Production changes of these magnitudes present severe marketing problems to the industry.

Table 1.--Total annual tart cherry production in the United States and change from previous year

Year	Production	Production change from previous year	
	Tons	Tons	Percent
1945	45,760		
1946	116,050	+70,290	+154
1947	90,970	-25,080	-22
1948	131,790	+40,820	+45
1949	108,290	-23,500	-18
1950	155,240	+46,950	+43
1951	156,760	+1,520	+1
1952	117,050	-39,710	-25
1953	131,490	+14,440	+12
1954	106,320	-25,170	-19
1955	149,070	+42,750	+40
1956	99,040	-50,030	-34
1957	146,670	+47,630	+48
1958	103,410	-43,260	-29
1959	138,060	+34,650	+34
1960	116,140	-21,920	-16
1961	165,370	+49,230	+42
1962	176,740	+11,370	+7
1963	81,800	-94,940	-54

Source: Crop Reporting Board, Statistical Reporting Service, U.S. Department of Agriculture.

Number of Trees

Tart cherry production in the Great Lakes States is concentrated in a few counties, as indicated in figure 3. Most of the important tart cherry counties border on one of

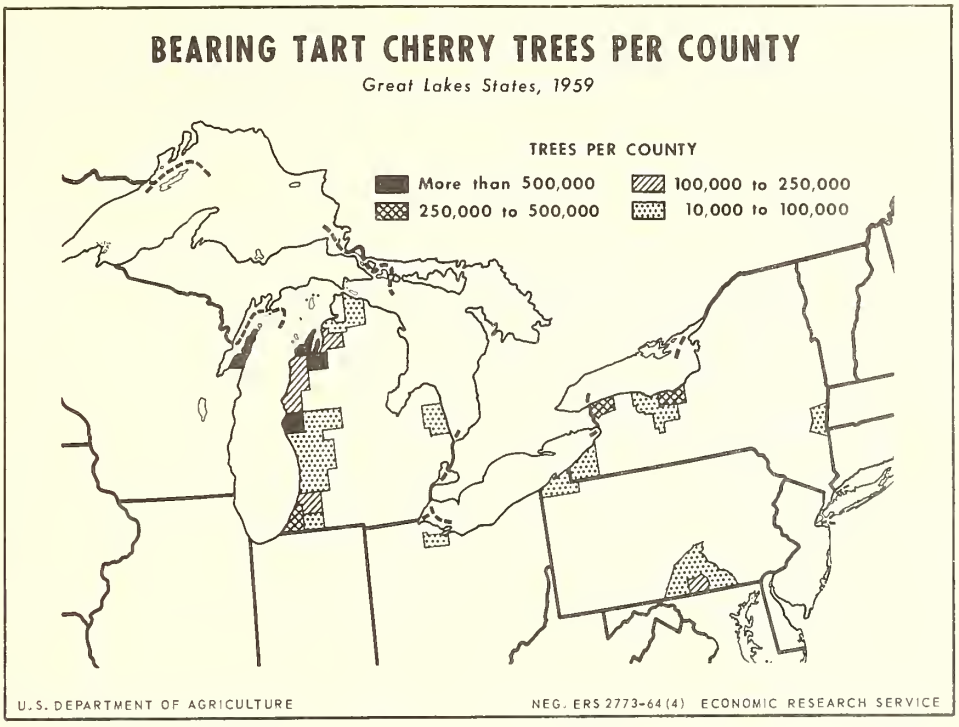

Figure 3

the Great Lakes, especially Lake Michigan. Figure 4 shows the numbers of tart cherry trees in census years in individual Great Lakes States and the combined Western States. The number of bearing trees increased substantially over this period only in Michigan. Wisconsin and Pennsylvania had small increases; New York had a slight decrease. Ohio and the Western States had substantial decreases.

The number of nonbearing tart cherry trees increased from 1940 to 1950 in all of the commercial tart cherry States except Ohio. In that decade, the total number of nonbearing tart cherry trees in the United States increased from 834,000 to more than 1.9 million. More than half of this increase was in Michigan. In the following decade, the total in the United States decreased by 520,000 and one-fourth of this decrease was in Michigan. 4/ Only two States, Utah and Wisconsin, had increases from 1950 to 1959.

The number of nonbearing tart cherry trees reached a peak in the 1950's before declining at the end of the decade. The effect of large tart cherry plantings in the late 1940's and early 1950's was beginning to become apparent in production in the early 1960's (fig. 1).

Per capita use

Over a period of years, total consumption of tart cherries is approximately equal to total production, so consumption as well as production is indicated in figure 1. However, because of increasing population, it is possible to have a stable or increasing total consumption, but decreasing per capita consumption. Figure 5 shows the annual

4/ This may overstate the decrease to some extent. Tree numbers reported in 1950 and 1959 are not strictly comparable due to a 1954 change in census definition of size of fruit tree holdings to be reported. However, the conclusions drawn here are believed valid.

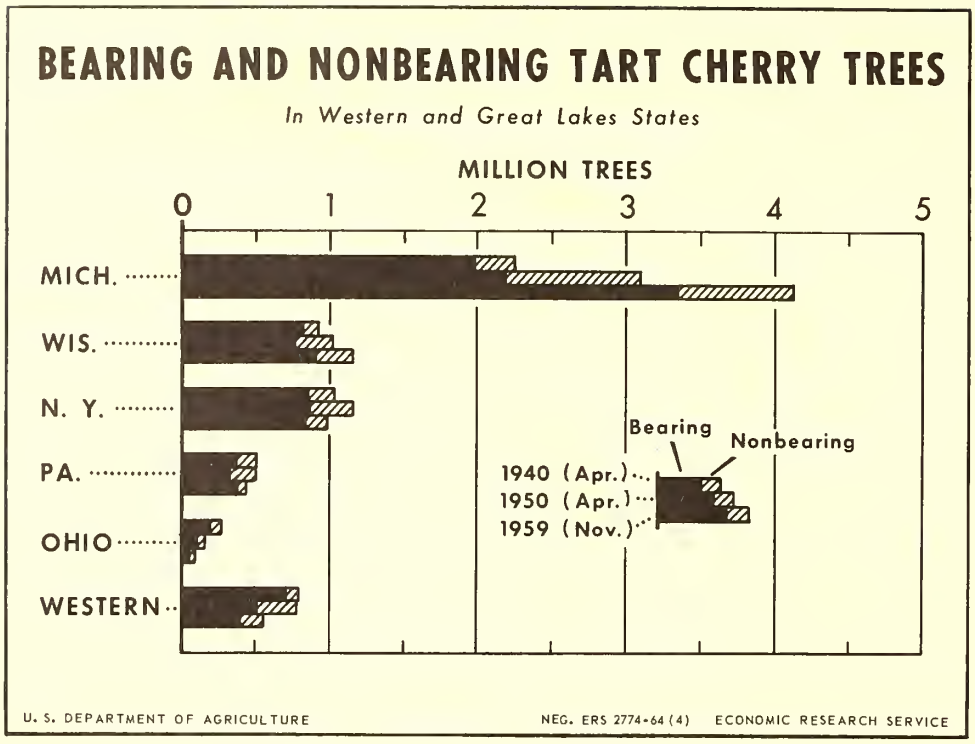

Figure 4

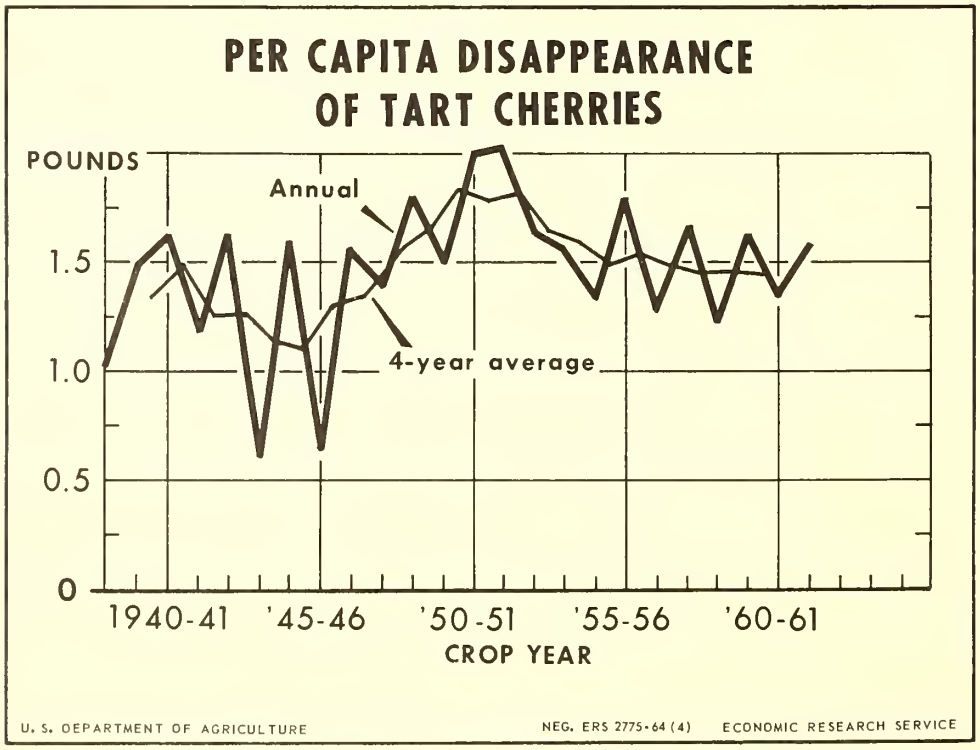

Figure 5

and 4-year average disappearance (production plus carryin minus carryout) 5/ of tart cherries. Per capita use of tart cherries decreased into the mid-1940's, then increased until about 1950 and has decreased since that time.

Form of product

Data available for the years since 1938 show a definite trend in form of tart cherry product used. Figure 6 shows 4-year averages of percentages going into various use categories. Few, if any, fruits have so high a percentage of the crop going into processing outlets. The total pack of frozen tart cherries increased rapidly in this period, while "canned" and "fresh sales and home use" decreased as percentages of total production.

While changes in utilization have generally been in the same direction throughout the country, the relative levels of utilization and magnitudes of change have varied considerably by area. In Michigan, changes in utilization were similar to those in the United States, although "frozen" increased more, "canned" decreased more, and "fresh sales and home use" was at a lower level. New York production went primarily to freezers throughout this period. There was relatively little trend in utilization in Wisconsin. The biggest change in Pennsylvania and Ohio was the movement from "fresh sales and home use" to the processed forms. The Western States appeared to be moving from canning to freezing in the early years of this period, but reversed that trend in the late 1940's when both processed forms gained and "fresh sales and home use" decreased. 6/

An important conclusion to be made from the differences in utilization by area is that those areas which produce the largest quantities also process the largest proportions of their production. The percentage of the tart cherry crop used for fresh sales and home use is smallest in Michigan, the State of largest production. At the other extreme, the Western States, in each of which only a small quantity of tart cherries is produced, utilize a high--although decreasing--percentage of their production for fresh sales and home use. As with many agricultural products, increasing concentration of production and of processing occur simultaneously.

Prices

Average prices received for tart cherries tripled from 1938-42 to 1943-47 (fig. 7). However, prices decreased greatly in the following years and have remained at lower levels. 7/ Prices in Michigan, the major tart cherry State, have usually been very near the U.S. average. New York, Pennsylvania, and Ohio have usually commanded somewhat higher prices than other States. This was especially true in Ohio in the last decade.

5/ Carryin is the quantity of canned and frozen tart cherries held in storage on July 1 of the crop year. Carryout is the quantity of canned and frozen tart cherries held in storage on July 1 of the following year. Carryout of one year is equal to carryin of the following year.

6/ One of the reasons for the decreasing trend in the "fresh sales and home use" category in all States is the increase of sales by processors of pitted and frozen or chilled cherries to local consumers. These sales undoubtedly have replaced previous fresh sales and home use cherries.

7/ The change in general price level accounts for most of the price increase between the 1938-42 and 1958-62 periods. Use of the index of wholesale prices for farm products to reduce 1958-62 average prices to the 1938-42 average price level results in the following prices. Western - $70, United States - $69, Michigan - $68, Wisconsin - $70, Ohio - $86, New York - $72, and Pennsylvania - $74. When placed on this basis, prices which appear to have approximately doubled in most instances are somewhat less in the later than in the earlier period.

Average prices presented in this section are for all types of utilization.

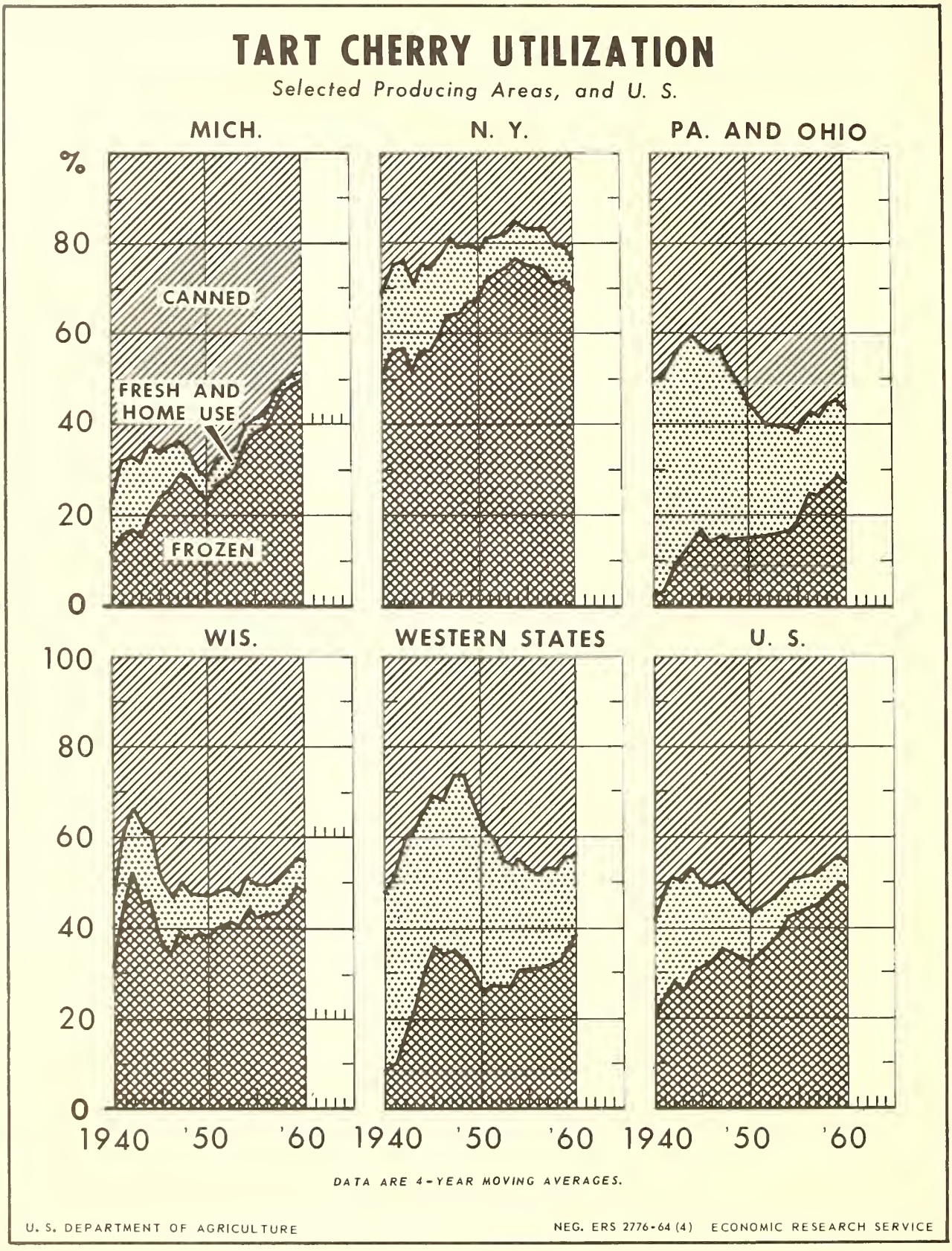
TART CHERRY UTILIZATION
Selected Producing Areas, and U. S.
MICH.
N. Y.
PA. AND OHIO
WIS.
WESTERN STATES
U. S.
%
100
80
60
40
20
0
CANNED
FRESH AND HOME USE
FROZEN
1940
'50
'60
DATA ARE 4-YEAR MOVING AVERAGES.
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Figure 6

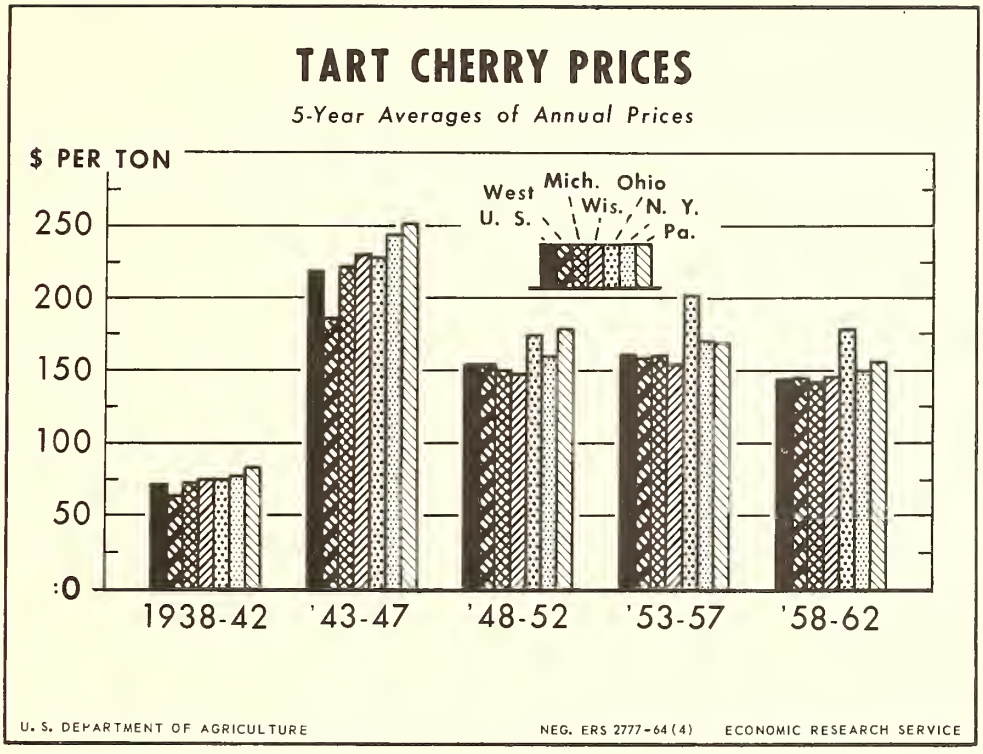

Figure 7

The Wisconsin price is near the Michigan price but often somewhat higher. In recent years, average prices received in the Western States have improved relative to the U.S. average, but are not as favorable as could be expected in minor producing areas.

The price relationships shown in figure 7 and production relationships in figure 2 indicate the complexity of the problem of estimating areas of future expansion. On the basis of prices alone, one would have expected greatest expansion in New York, Pennsylvania, and Ohio--with relatively little expansion in Michigan. But the opposite occurred. Production costs undoubtedly are important in making production plans, but it will be shown later that in the four major tart cherry States, these costs are not greatly different. Availability of good sites for expansion and profitability of alternative uses of these sites also are important determinants of the location of tart cherry production.

GROWING AND HARVESTING COSTS

Cost estimates of tart cherry growing and harvesting have been prepared for the four major Great Lakes tart cherry States. Many individuals took part in these studies and research procedures followed are not entirely comparable among areas. As a result, costs reported in these studies are not entirely comparable. This report combines key results of individual reports, and adjustments are made of some of the costs to increase uniformity and comparability among States. These adjustments were made after study of various reports and consultation with the individuals who made or directed the studies. Only as many data as are essential for comparison purposes are presented here; more complete data can be obtained from various State publications.

Michigan

The Michigan study was conducted in 1961. In this study, the three fairly distinct producing areas were studied separately and the results combined into a State average. A sample of approximately 15 producers was selected in each area on the basis of their acreage, and their willingness to keep records of all tart cherry inputs for a year. Twelve producers kept complete records in two of the areas, and 13 kept them in the third area. The results of this study have not been published, but portions of the data obtained are summarized in tables 2 and 3. 8/

New York

The New York study also was conducted in 1961. 9/ A sample of New York producers, stratified by acreage of tart cherries, was drawn. Costs and physical inputs were obtained from these producers from their records or on a recall basis. Fifty-eight farms were included in the sample: 13 small, 24 medium size, and 21 large operations. One or more visits were made to each farm to obtain estimates of growing inputs and one to obtain estimates of harvesting inputs. The results are summarized in tables 4 and 5.

Pennsylvania

Costs reported for Pennsylvania (tables 6 and 7) are based on records kept for 1959-61 by 12 tart cherry producers in Adams and Franklin Counties. 10/ While the sample is small, the costs obtained are believed to be representative of the major Pennsylvania producing area. This study differs from the New York and Michigan studies in that it is continuous and the producers in the sample kept records on the entire farm operation.

Wisconsin

Wisconsin is the only major tart cherry-producing State for which a production cost study has not been made. The producing area of Wisconsin (Door County) is located directly across Lake Michigan from the Northwest Michigan producing area. Therefore, costs reported for Wisconsin are based to a large extent on results in Northwest Michigan.

Before adapting the Michigan data to Wisconsin, producers and processors in Door County were interviewed to develop cost estimates and to obtain general information on the Wisconsin tart cherry industry. Where definite differences in cost components were indicated, adjustments were made in the Michigan cost data. These adjustments can be identified by comparing the Northwest Michigan growing costs (table 2) with those of Wisconsin (table 8).

8/ This study was conducted as a project for a Master's thesis by Donald Stover.

9/ Dominick, B. A. Jr. A Comparison of Costs and Returns in Producing Red Tart Cherries on Your Farm with 58 Western New York Fruit Farms, 1961. A.E. Ext. 209, Dept. Agr. Econ., Cornell Univ., Ithaca, N.Y., Sept. 1962.

Myszkowski, E. J. Jr. Costs and Physical Inputs in Producing Red Tart Cherries. Dept. Agr. Econ., Cornell Univ., Ithaca, N.Y. A.E. Res. 105, Nov. 1962.

10/ Kelly, B. W. Factors Related to the Cost of Producing Cherries in Pennsylvania, 1959-61. Col. Agr. Extension Serv., Pa. State Univ., Univ. Park, Farm Management - 7.

Table 2.--Costs per acre of growing tart cherries in Michigan, 1961

Item	Northwest	Central West	Southwest	State
	Yield-tons per acre			
	3.53	3.40	5.79	4.24
	Dollars			
Labor				
Operator	20.77	11.07	20.11	17.15
Hired	8.19	19.93	26.69	18.31
Power (tractor)	10.64	15.63	17.72	14.68
Truck and auto	7.78	5.52	6.13	6.45
Gas and oil (sprayer)	1.35	1.59	1.77	1.57
Special equipment	12.36	12.97	13.30	12.88
Custom work hired	7.75	--	.90	2.80
All sprays and dusts	24.00	22.02	21.22	22.40
Commercial fertilizer and lime	20.51	19.79	19.55	19.75
Manure	3.58	.92	2.62	2.33
Cover crop seed	1.77	1.58	1.08	1.48
Replanted trees	1.22	1.03	1.33	1.19
Frost protection equipment	--	--	2.76	.89
Mouse bait	.37	.37	1.19	.63
Bees	1.43	.79	1.83	1.33
Hail insurance	2.73	--	--	.88
Irrigation	--	--	3.99	1.29
Property taxes	6.79	4.27	6.70	5.87
General overhead	2.00	2.00	2.00	2.00
Interest	1.94	1.74	1.95	1.87
Other	--	.80	.41	.42
Subtotal	135.18	122.02	153.25	136.17
Land charge	38.75	27.23	32.50	32.67
Tree depreciation	44.46	44.46	44.46	44.46
Total	218.39	193.71	230.21	213.30
	Cents			
Cost per pound	3.09	2.85	1.99	2.52

PRODUCTION COST DIFFERENCES

The cost of producing tart cherries may vary with location for several reasons, including differences in the importance of tart cherries in the overall farm organization; differences in soil, site, temperature, and rainfall; differences in the difficulty of control of diseases and pests; and differences in wage rates and materials prices.

Specialization and diversification

Specialization in a farm operation is a way of obtaining production cost advantages through better management and more efficient utilization of equipment. Through diversification, the workload can be spread over a longer period of the year, enabling more complete use of available labor and, in some cases, of equipment and other facilities. Also, diversification can be used to spread risk. A producer is less likely to have a

Table 3.--Costs of harvesting tart cherries in Michigan and in 3 areas in the State, 1961

Item	Estimate of proportionate change of cost with change of yield	Cost per acre at given yield			
		Northwest Yield 3.53T/A	Central West Yield 3.40T/A	Southwest Yield 5.79T/A	State Yield 4.24T/A
		Dollars			
Picking labor	1.0	171.96	165.62	256.90	197.94
Truck and auto	1.0	5.50	4.16	6.00	5.18
Custom work	1.0	4.43	2.00	--	2.07
Marketing cooperatives fees	1.0	8.80	10.56	16.41	11.97
Association fees	1.0	7.07	6.77	11.45	8.42
Operator labor	.5	10.92	7.10	16.66	11.45
Hired labor	.5	12.96	11.76	19.96	14.86
Power	.5	6.16	5.04	8.42	6.51
Harvesting equipment	.5	3.77	3.16	3.09	3.32
Housing	0	4.68	4.85	5.97	5.17
Overhead	0	4.00	4.00	4.00	4.00
Total		240.25	225.02	348.86	270.89
		Cents			
Cost per pound		3.40	3.31	3.01	3.19

complete economic failure from a combination of several enterprises than from a single enterprise. It may be preferable to settle for a somewhat lower average annual income in order to have a more stable income.

Producers of tart cherries in general are attempting to obtain the advantages of both specialization and diversification. They are diversifying in that they produce other fruits and vegetables. At the same time, they are specializing in that they are eliminating most other enterprises.

In Wisconsin, tart cherries are produced largely on diversified dairy farms. Although this will continue, it is expected that the future trend will be toward diversification in fruit, with a gradual decrease of combinations with dairy and other enterprises. Northwestern Michigan is experiencing a move from highly specialized tart cherry operations to combinations of tart cherries and other fruits such as apples, sweet cherries, and prunes. In central western Michigan, the trend is more to diversified fruit farms and less to combination with general farming. Southwestern Michigan has long been a diversified fruit production area but is becoming even more specialized in fruit production.

New York and Pennsylvania are similar with respect to organization of farms on which tart cherries are produced. In general, tart cherries are produced on specialized fruit farms, and they often are of less importance than other fruits on these farms. Apples are a primary source of income on many of these farms. In the cost study of New York's tart cherry production, it was found that among those farms having the largest acreages of tart cherries, specialized fruit farms predominated; apples were the main source of income, and livestock were of minor importance. The farms having small tart cherry acreages were generally less specialized, small, and often part-time operations.

Table 4.--Costs per acre of growing tart cherries in New York, 1961

Item	Size of enterprise 1/			State average 2/
	Small	Medium	Large	
	Yield-tons per acre--			
	3.6	3.4	3.3	3.337
	Dollars			
Labor	34	31	21	23.88
Land	40	35	42	40.33
Power	22	13	10	11.26
Truck and auto	7	2	3	2.97
Special equipment	12	15	10	11.22
All sprays and dusts	22	28	24	24.80
Fertilizer and manure	12	13	18	16.59
Other	4	4	5	4.73
General overhead	2	2	2	2.00
Interest	1	2	1	1.22
Subtotal	156	145	136	139.00
Tree depreciation	44.46	44.46	44.46	3/44.46
Total	200.46	189.46	180.46	183.46
	Cents			
Cost per pound	2.78	2.79	2.73	2.75

1/ Tart cherry acreage ranges are: Small, 2-5; medium, 6-20; and large, 21 and over.
2/ Costs for size categories weighted by the number of acres represented in each category.
3/ Tree depreciation was estimated only in the Michigan study. It is included here at the same level as in the Michigan study to increase comparability of results.

Trees per farm

There is no typical orchard size. Table 9 gives the numbers of farms reporting bearing tart cherry trees and the estimated percentages of trees in each size category for the major Great Lakes States. Farms reporting bearing tart cherry trees are distributed through the size categories, with the greatest number of farms being in the smallest size category in each instance.

The numbers of tart cherry trees on farms of different sizes show that the small tart cherry holdings, while numerous, account for only minor numbers of trees (table 9). In Pennsylvania, 9 percent of the bearing tart cherry trees were on farms having less than 20 trees. In the other three States, 2 percent or less of the trees were in this category. Pennsylvania is also unusual in the percentage of trees in large holdings, 22 percent of the trees being in the 5,000 and over categories. Wisconsin has an exceptionally high percentage in the largest size category.

The average number of bearing trees per farm reporting tart cherry trees in the 1959 census was largest in Michigan, with 593, followed closely by Wisconsin with 535, New York had 300 trees per reporting farm; Pennsylvania averaged only 86.

Table 5.--Costs per acre of harvesting tart cherries in New York, by size of enterprise, 1961

Item	Estimate of proportionate change of cost with change of yield	Size of enterprise 1/			State average 2/ (yield 3.37T/A)
		Small (yield 3.6T/A)	Medium (yield 3.4T/A)	Large (yield 3.3T/A)	
		Dollars			
Picking labor	1.0	192	183	196	192.88
Truck and auto	1.0	15	8	7	7.61
Selling expense	1.0	13	15	13	13.45
Farm labor	.5	35	25	20	21.85
Power	.5	16	9	6	7.16
Harvest equipment	.5	3	3	5	4.45
Overhead	0	2	2	2	2.00
Other	0	4	4	4	4.00
Total		280	249	253	253.40
		Cents			
Cost per pound		3.89	3.66	3.83	3.80

1/ Tart cherry acreage ranges are: Small, 2-5; medium, 6-20; and large, 21 and over.
2/ Costs for size categories weighted by the number of acres represented in each category.

Soil and air drainage

Good soil and air drainage are essential for successful tart cherry production. Tart cherry trees are especially sensitive to poor soil drainage. Without it, root penetration is poor and the tree lacks vigor. The effect of shallow roots due to poor soil drainage may be apparent only in a very wet season when the roots are flooded or a very dry season when the tree suffers from lack of moisture.

Good air drainage is a primary factor in profitable tart cherry production. The importance of air drainage increases for orchards located in areas with more severe climate problems and farther from the temperature-modifying influence of the Great Lakes. Sites that are subject to spring frosts are not suitable for tart cherries. Orchards are best situated on slopes where cold air can drain to lower levels. The advantage of a location near a large body of water is twofold. First, air off the water tends to remain cool later in the spring, thereby delaying blossoming until frost danger has lessened. Second, frosts are less likely to occur late in the spring.

Sites with good air drainage and potentially good water drainage are still plentiful in all the Great Lakes States, though not necessarily in all sections of these States. The lack of good sites is considered a serious curb on tart cherry expansion only in the southwestern part of Michigan. However, as other fruits take up the better sites, this may become a more restricting factor in the other areas within a few years.

Table 6.--Costs per acre of growing tart cherries in Pennsylvania, 1961
(yield - 2.675 tons/acre)

Item	Dollars
Orchard protection	1.78
Fertilizer and lime	8.56
Planting	.61
Bees	.28
Spray	38.05
Interest paid*	4.58
Depreciation*	16.92
Land charge	21.96
Taxes	3.13
Insurance	5.63
Labor, family*	27.13
hired*	50.67
License	.60
Fuel, oil, grease*	8.10
Repairs, machinery and building*	12.81
Miscellaneous costs*	11.11
Cover crop	.02
Interest on machinery; investment*	5.02
Tree depreciation	2/44.46
Total	261.42
Deduction for reassignment to harvesting cost 1/.	60.00
Total less deduction	201.42
	Cents
Cost per pound	3.76

1/ This is an arbitrary estimate of portions of items marked with an asterisk--the portions which are "harvesting" rather than "growing" expense. The estimating is done this way to increase comparability between regions and is based on the nonpicking harvesting expenses of the New York study (table 4).

2/ Tree depreciation was estimated only in the Michigan study. It is included here at the same level as in the Michigan study to increase comparability of results.

Pruning

Pruning is an important and costly activity in tart cherry production, but the costs of pruning are not readily available. Interviews with producers and Extension Service personnel give reason to believe that pruning practices do vary by area. In Pennsylvania, heavy pruning is done in alternate years, light pruning the other years. In New York, many growers trim all mature trees to some extent every year, although some prune only once in 2 years. Pruning practices in Michigan seem to vary with location, but it is unlikely that the average tart cherry tree is pruned more than once every 4 or 5 years. In the central west area of the State, trees are pruned more often; in the northwest area, less often. Wisconsin pruning practices vary considerably. Few producers prune each tree more often than once in 2 years, and many producers have adopted a "minimum" pruning policy, giving as a reason the low profitability of this enterprise.

Table 7.--Costs per acre of harvesting tart cherries in Pennsylvania, 1961 (yield - 2.675 tons/acre)

Item	Dollars
Picking	111.25
Hauling	.61
Total	111.86
Other 1/	60.00
Total	171.86
	-Cents-
Cost per pound	3.21

1/ This is an arbitrary estimate of portions of items marked with an asterisk in table 5 (production costs), which should be assigned as "harvesting" rather than "growing" expense. It is done to increase comparability of these cost divisions between regions and is based on the nonpicking harvesting expenses of the New York study (table 4). In following calculations of harvesting costs, $33 of this amount is considered as fixed, and $27 varies in proportion with yield.

Fertilization

Fertilization accounts for one of the large differences in tart cherry growing costs. The total costs of manure and fertilizer varied from a high of $22.08 per acre in Michigan to a low of $8.56 per acre in Pennsylvania. Manure is a minor portion of this cost in all of these States.

There is considerable variation in fertilization practices within each State. Some producers use little or no fertilizer and others fertilize heavily. Some apply only nitrogen, but most producers use a complete fertilizer. The difference among States in average cost per acre for commercial fertilizer is primarily due to the level of fertilization, i.e., the pounds applied, rather than the type of fertilizer. Michigan, for instance, reports applications of 6 to 10 pounds of ammonium nitrate per tree. Pennsylvania reports approximately 50 pounds per acre (less than 1 pound per tree), with a recommendation of one-eighth pound per tree per year of age.

Sprays

The cost of spray materials varies greatly among States. In Wisconsin, spray materials are estimated to cost $18.00 per acre. In Pennsylvania, the estimate is $38.05. Estimates for Michigan and New York--$22.40 and $24.80--are relatively near the Wisconsin estimate.

Sprays are used for weed control, disease control, and insect control. Costs of spray materials in the State studies are not divided according to the purposes of the spray, but only a minor part of these costs would be for weed control in any State. Insect and disease control sprays are often applied simultaneously, making separation of these costs difficult.

Table 8.--Costs per acre of growing tart cherries in Wisconsin, 1961

Item	Dollars
Labor, operator	20.77
hired	6.94
Power (tractor)	9.58
Truck and auto	7.78
Gas and oil (sprayer)	.90
Special equipment	12.36
Custom work hired	7.75
All sprays and dusts	18.00
Commercial fertilizer and lime	13.00
Manure	3.58
Cover crop seed	1.77
Replanted trees	1.22
Mouse bait	.37
Bees	1.43
Property taxes	6.30
General overhead	2.00
Interest	1.94
Subtotal	115.69
Land charge	32.70
Tree depreciation	44.46
Total	192.85

Spray materials for disease and insect control differ by area--both in kind and quantity. These differences are due largely to the extent of disease and insect problems. While the number of sprays per year is not a complete indicator of the amount or cost of spray materials used, it is one of the important variables. In this respect, the most common number of sprays in Pennsylvania is seven, in New York and Michigan, six, and in Wisconsin, five or less.

Harvesting season

Tart cherry harvest dates vary somewhat from year to year, both as to beginning date and length of harvest season. However, "normal" harvest dates provide a good indication of the harvest period for most years.

Tart cherries normally are harvested in the United States as early as June 15 (Utah) and as late as August 15 (Montana). 11/ In the major tart cherry States, the early harvest date is June 25 (South-Central Pennsylvania) and the late date is August 18 (Wisconsin). Most of the tart cherries in any given producing area are harvested in a 15-day period, with a total area harvest season of approximately 1 month (table 10). Thus, the entire tart cherry crop must be harvested in a short time, and speed is important.

11/ From Royston, R., Holmes, I., and Park, E. L. Fruits and Tree Nuts, Bloom, Harvesting, and Marketing Dates, and Principal Producing Counties, By States. Agr. Handb. 186, U.S. Dept. Agr., July 1960.

Table 9.--Number of farms reporting specified numbers of bearing tart cherry trees 1/, and percentage of trees in each size category 2/, by States, 1959

Number of bearing trees (size category)	Michigan		New York		Pennsylvania		Wisconsin	
	Farms reporting	Percent of trees in state	Farms reporting	Percent of trees in state	Farms reporting	Percent of trees in state	Farms reporting	Percent of trees in state
	Farms	Percent	Farms	Percent	Farms	Percent	Farms	Percent
Under 100	2,271	1	1,515	4	3,646	11	1,147	2
100-199	465	2	376	6	130	5	50	1
200-499	986	9	529	18	128	11	117	6
500-999	935	19	323	24	121	22	175	20
1000-1499	404	14	101	13	15	5	85	16
1500-1999	243	11	67	12	6	3	45	12
2000-2999	218	15	33	8	20	12	20	8
3000-4999	162	17	35	14	9	9	20	12
5000-9999	40	8	1	1	8	15	--	3/
10,000 or more	10	4	1	1	2	7	9	21

1/ Michigan and Wisconsin data from published Bureau of the Census reports. New York and Pennsylvania data from unpublished materials provided by the Bureau of the Census.

2/ Number of trees in each category estimated from number of farms and midpoint of census category. The "under 100" group is broken into four categories in census reports. The midpoint of the "10,000 or more" category is assumed to be 15,000. Sum of categories for a State may vary from 100 due to rounding.

3/ Less than one-half of 1 percent.

Table 10.--Usual tart cherry harvesting dates in New York, Pennsylvania, Michigan, and Wisconsin

State and area	Usual date harvesting--		
	Begins	Is most active	Ends
New York			
West	July 10	July 15-30	Aug. 5
Hudson Valley	June 25	July 5-20	July 30
Pennsylvania			
South Central	June 25	July 5-20	July 25
Northwest	July 1	July 10-25	Aug. 1
Michigan			
Northwest	July 12	July 15-Aug. 11	Aug. 10
West Central	July 5	July 10-25	Aug. 1
Southwest	June 30	July 5-20	July 25
Wisconsin			
East	July 15	July 20-Aug. 5	Aug. 18

Source: Royston, R., Holmes, I., and Park, E. L. Fruits and Tree Nuts, Bloom, Harvesting and Marketing Dates and Principal Producing Counties. Agr. Handb. 186, U.S. Dept. Agr., July 1960, pp. 66-68.

Picking

The tart cherry harvest in major producing areas has required a large influx of pickers from outside the producing area. These pickers sometimes have been recruited from nearby cities, as is the case in Pennsylvania, but most major areas must obtain pickers from distant places such as Texas and Jamaica. The availability of this labor for the tart cherry harvest depends to a large extent upon the availability of other work before and after the cherry harvest. Other crops, mainly fruits and vegetables, have helped supply work for imported laborers. This has given an advantage in labor recruitment to diversified fruit and vegetable areas since the worker has relative stability and assurance of several months of work. However, mechanization of production and harvesting of many fruits, vegetables, and other crops, has reduced manual labor requirements. The resulting decrease in need for migrant workers has increased the difficulty of obtaining pickers.

Another problem involved in hand picking of tart cherries is difficulty in providing acceptable housing for migrant workers. The requirements for approved housing have become more rigid, and the pickers are demanding better housing. Greater effort and expense are required of the producer.

The increasing problems and expense of hand picking have brought forth considerable effort to develop equipment for mechanical harvesting of tart cherries. Successful mechanical harvesters have been developed, but they do not as yet harvest a large share of the crop. Due to lack of experience with present mechanical harvesting equipment, estimates of mechanical harvesting costs vary widely.

Ricks and Wheeler 12/, using physical estimates obtained in various studies, developed and compared hand and mechanical harvesting cost estimates. They state that "the income figures ... indicate that farms with as few as 7 acres of tart cherries may realize a profit from mechanical harvesting if average yields of 6 tons per acre are obtained. With average yields of 4 tons per acre, a tart cherry enterprise of nearer 14 acres is needed to realize an increase in income from owning and operating mechanical harvesting equipment."

The importance of obtaining high yields is shown by comparing their estimates of the cost advantage of mechanical harvesting at high and low yields. With 40 acres of tart cherries which yield an average of 6 tons per acre, total mechanical harvesting costs are estimated at $4,750, or approximately 35 percent of the hand harvesting costs. If the yield averages only 2 tons per acre, mechanical harvesting costs are estimated at $4,350, which is 75 percent of the hand harvesting cost.

Harvesting costs

Harvesting costs presented in this study are entirely for hand picking because mechanical harvesting was not being used by a sufficient number of the producers in the study groups to prepare estimates.

Total harvesting costs per pound do not vary greatly from State to State, but do appear to be somewhat higher in New York than in the other States. The cost of harvesting tart cherries is composed mainly of picking labor cost but does include several additional charges, as can be seen in tables 3, 5, and 7. Much of the harvest cost is a constant amount per pound over a wide range of yield. However, several of the costs vary to some extent with yield and others vary little or not at all with yield. Esti-

12/ Ricks, D. J. and Wheeler, R. G. Farm Management Aspects of Mechanical Harvesting and Handling of Tree Fruits in Michigan. Quarterly Bul., Mich. Agr. Expt. Sta., Mich. State Univ., East Lansing, Vol. 43, No. 3, pp. 606-617, Feb. 1961.

mates of the relationship of yield variation and cost are given in the harvest cost tables to enable cost estimates at yields other than those of the cost study producers.

Total unit costs

Total cost estimates for growing and harvesting tart cherries are given in table 11. Total costs per pound are shown to be very similar for each State if similar yields are obtained. For example, at a yield of 4,000 pounds per acre, total costs range from 8.35 (Pennsylvania) to 9.03 (New York) cents per pound, a difference of only 0.68 cents. At a yield of 10,000 pounds per acre, total costs range from 5.09 (Pennsylvania) to 5.68 (New York) cents per pound, a difference of only 0.57 cents. This does not necessarily mean that average costs in each State are actually very nearly the same, although it seems likely that this is true. Yield, which varies both within and between States, is an important unit cost determinant. For instance, cost estimates of table 11 shown that total cost per pound is only about one-third as great with a 6-ton yield as with a 1-ton yield.

Table 11.--Estimated cost per pound to grow and harvest tart cherries in Michigan, New York, Pennsylvania, and Wisconsin

State and yield per acre in pounds	Growing	Harvesting	Total
	Cents		
Michigan			
2,000	10.67	4.24	14.91
4,000	5.33	3.55	8.88
6,000	3.56	3.33	6.89
8,000	2.67	3.21	5.88
10,000	2.13	3.15	5.28
12,000	1.78	3.10	4.88
New York			
2,000	10.02	4.59	14.61
4,000	5.01	4.02	9.03
6,000	3.34	3.84	7.18
8,000	2.51	3.74	6.25
10,000	2.00	3.68	5.68
12,000	1.67	3.64	5.31
Pennsylvania			
2,000	10.07	3.70	13.77
4,000	5.04	3.31	8.35
6,000	3.36	3.18	6.54
8,000	2.52	3.12	5.64
10,000	2.01	3.08	5.09
12,000	1.68	3.05	4.73
Wisconsin			
2,000	9.64	4.32	13.96
4,000	4.82	3.68	8.50
6,000	3.21	3.47	6.68
8,000	2.41	3.36	5.77
10,000	1.93	3.30	5.23
12,000	1.61	3.25	4.86

NET RETURNS

Production costs are important primarily as they are compared with returns. Table 12 shows the net returns per acre at given yields and prices received per pound when growing costs are $200 per acre and harvesting costs are 3.5 cents per pound. Under these cost and return conditions, a yield of 10,000 pounds per acre is required to "break-even" if the farm price received is 5.5 cents per pound. Other "break-even" combinations are 8,000 pounds per acre and 6.0 cents per pound, 5,000 pounds and 7.5 cents, and 4,000 pounds and 8.5 cents. "Break-even" prices at other yields fall between prices given in table 12. For instance, at a yield of 6,000 pounds per acre, the "break-even" price is between 6.5 and 7.0 cents (approximately 6.67 cents). If a curve were drawn through the zeros and other "break-even" yield-price combinations, it would appear as the $200 curve of figure 8.

Other similar curves are given in this figure to enable individuals to estimate "break-even" yield and price combinations at their production costs. If, for example, growing cost is $250 and yield is 5,000 pounds per acre, a price of 8.5 cents per pound is required for returns to equal expenses. If the same yield can be obtained with only $150 growing expense, a price of only 6.5 cents per pound is required to "break-even."

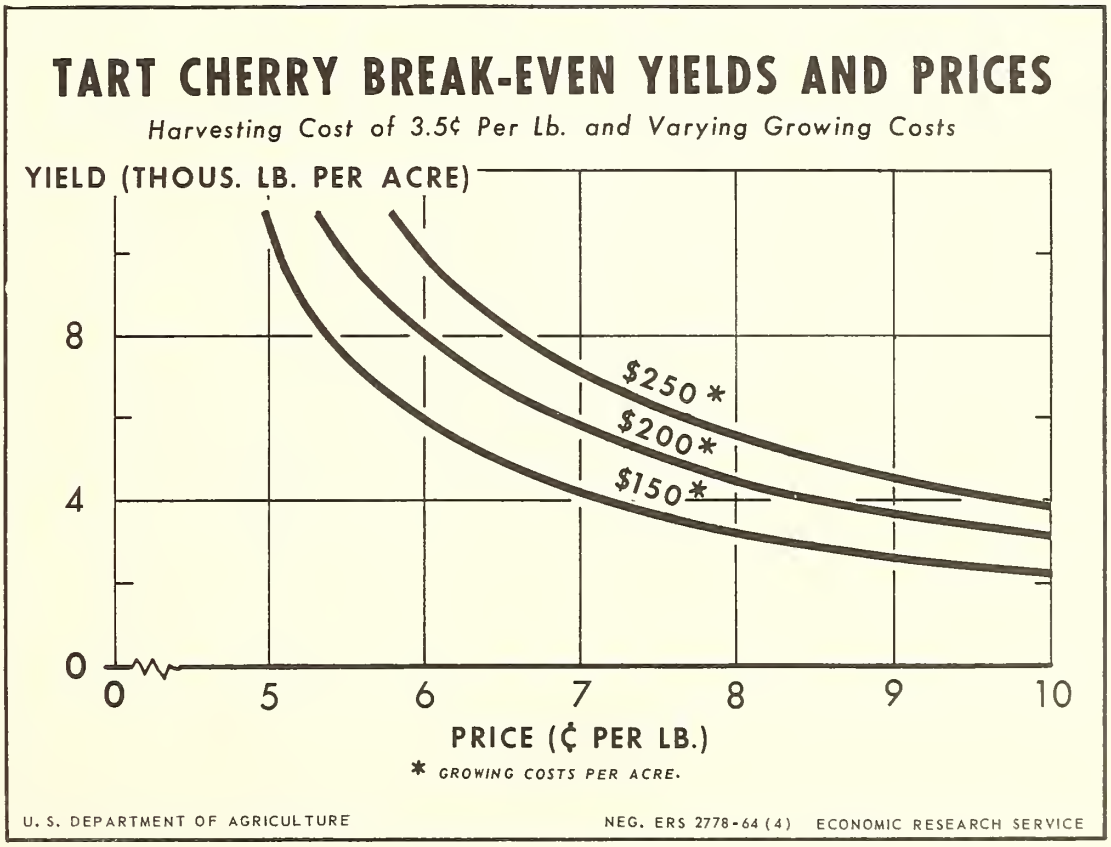

Figure 8

Table 12.--Net returns per acre from tart cherries at varying rates of total production and price per pound when growing costs equal $200 per acre and harvesting costs equals 3.5 cents per pound

Pounds per acre	Price - cents per pound												
	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
	Dollars												
11,000	-145	-90	-35	+20	+75	+130	+185	+240	+295	+350	+405	+460	+515
10,000	-150	-100	-50	0	+50	+100	+150	+200	+250	+300	+350	+400	+450
9,000	-155	-110	-65	-20	+25	+70	+115	+160	+205	+250	+295	+340	+385
8,000	-160	-120	-80	-40	0	+40	+80	+120	+160	+200	+240	+280	+320
7,000	-165	-130	-95	-60	-25	+10	+45	+80	+115	+150	+185	+220	+255
6,000	-170	-140	-110	-80	-50	-20	+10	+40	+70	+100	+130	+160	+190
5,000	-175	-150	-125	-100	-75	-50	-25	0	+25	+50	+75	+100	+125
4,000	-180	-160	-140	-120	-100	-80	-60	-40	-20	0	+20	+40	+60
3,000	-185	-170	-155	-140	-125	-110	-95	-80	-65	-50	-35	-20	-05
2,000	-190	-180	-170	-160	-150	-140	-130	-120	-110	-100	-90	-80	-70
1,000	-195	-190	-185	-180	-175	-170	-165	-160	-155	-150	-145	-140	-135